Partnerships for Clean Energy Development USDOE/Office of Weatherization and International Programs (OWIP) Project Opportunities Workshop

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California Energy Commission

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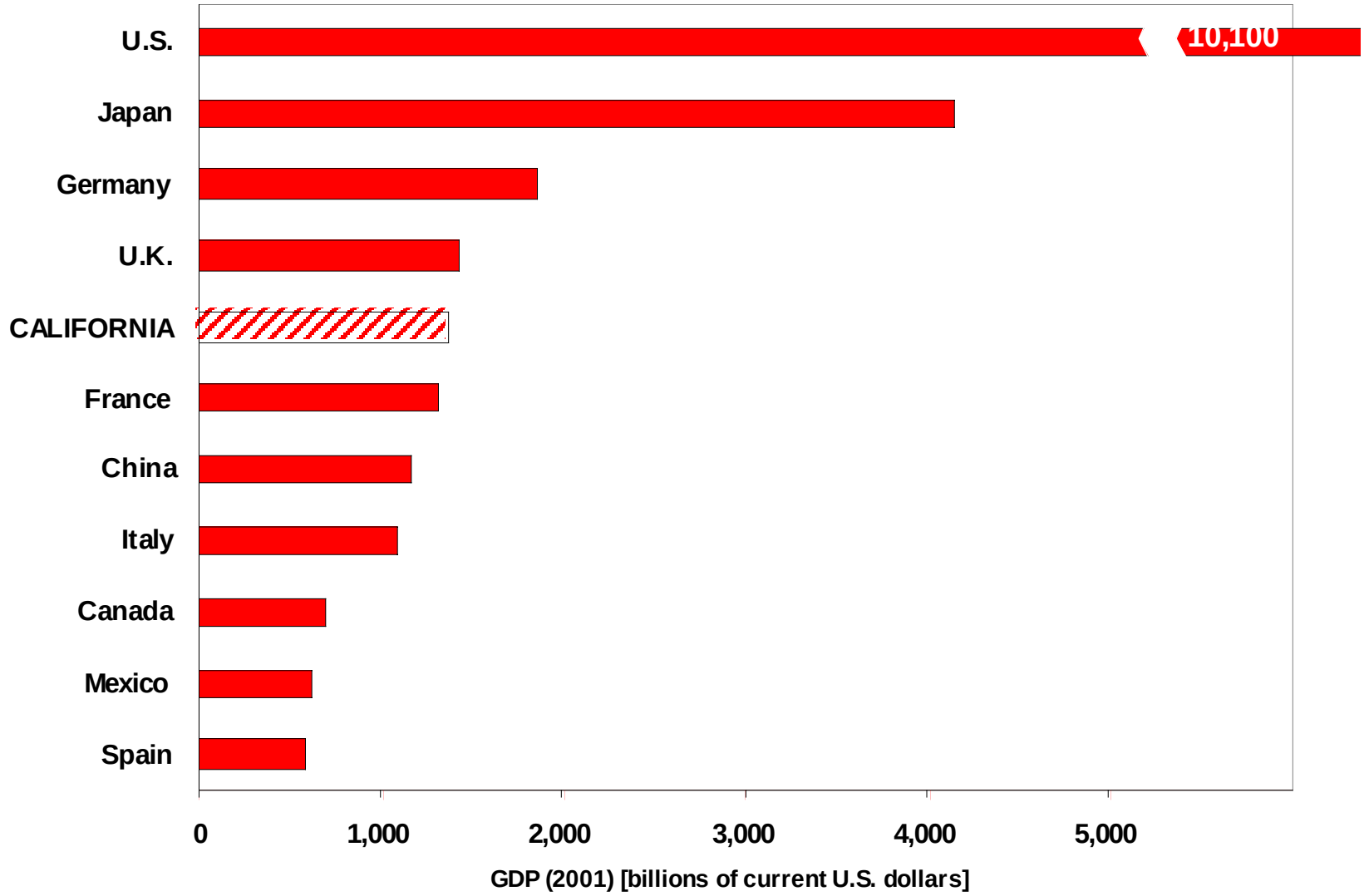
California in Context

- Size of the economy
  - **Gross state product in 2000 was about $1.35 trillion**
- Population
  - **Population grew from about 30 million in 1990 to about 34.5 million in 2002**
- History of encouraging economic growth, while maintaining an aggressive record for environmental protection

GDP (2001)


U.S.
Japan
Germany
U.K.
CALIFORNIA
France
China
Italy
Canada
Mexico
Spain
10,100
0
1,000
2,000
3,000
4,000
5,000
GDP (2001) [billions of current U.S. dollars]

California has Established a $62M/yr Public Interest Energy Research Program (PIER)

Economy: Affordable Solutions

Quality: Reliable and Available

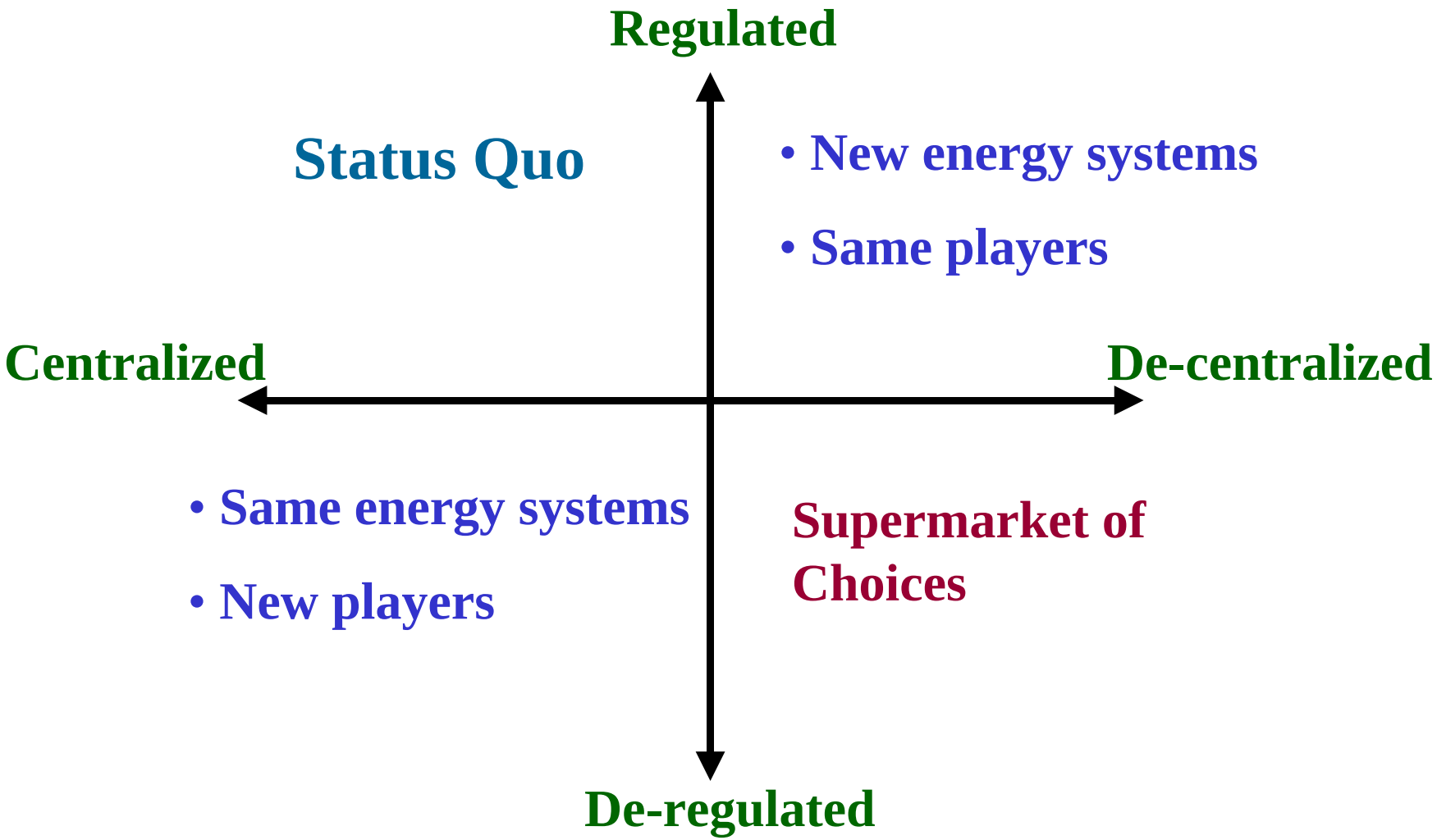
Environment: Protect and Enhance

California Must be Prepared to Face the Same Issues as Others Must

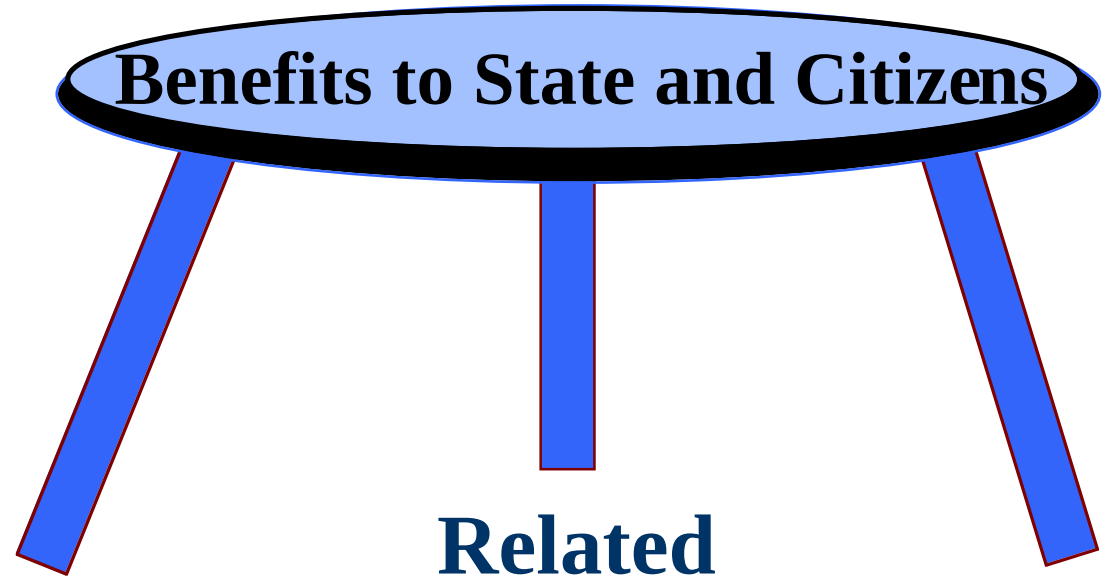
- **Economics**
  - Resource Competition
  - New technology market penetration
  - Lifecycle analysis
  - State/Federal laws
- **Environment**
  - Impact of new technologies
  - Climate change
  - Sustainable practices
- **Security**
  - Peak demand/demand response
  - Infrastructure interdependencies

Energy Costs Fundamentally Affect our Overall Economy

PIER Must Address Future Market Scenarios: A Goal is to Provide Greater End-User choice



Policy and RD&D Must Be Linked in Order to Provide Benefits to the State



California Issues

Related State Activities

Collaborations

Our Success is Coupled to the Successes of our Technology Partnerships

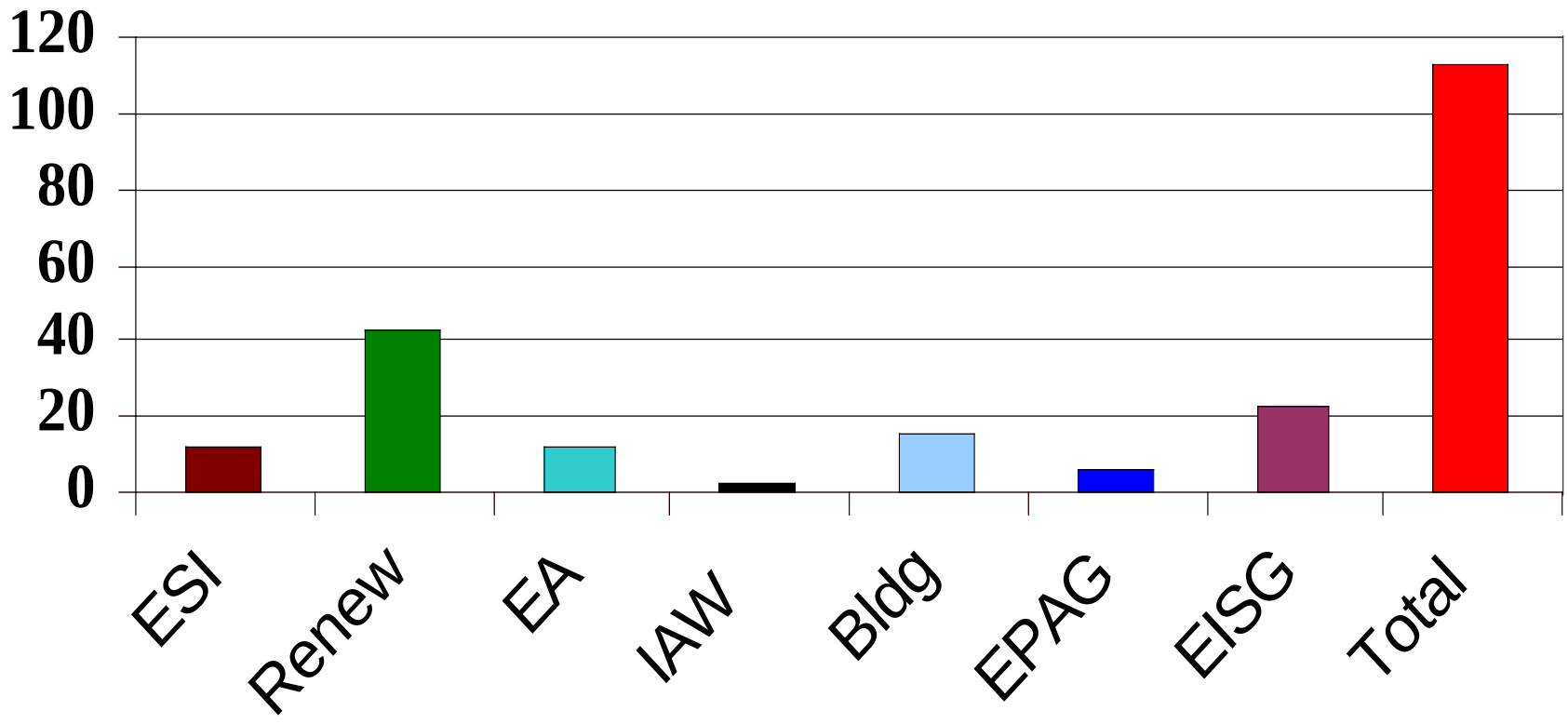
- **Universities – UCOP, standard contract**
- **Industries – funding, obtaining co-funding, pushing deployment**
- **Federal – Departments of Energy, Commerce, Agriculture**
- **National Laboratories – LBNL, NREL, LLNL, ORNL, NETL, SNL, ANL**
- **State – ARB, CDF, DWR, DOGGR, CFA, CPA, CPUC, DGS**

RD&D Activities Should Connect with Synergistic State Regulatory, Incentive, and Subsidy Programs

- **Buildings** – Titles 20 and 24
- **Renewables** – Renewable portfolio standard (RPS)
- **Environmentally-Preferred Advanced Generation** – 2007 ARB rules on distributed generation emissions
- **Energy Systems Integration** – CPUC/CEC initiatives in demand response/dynamic pricing, distributed energy resources, and transmission and distribution systems
- **Environmental** – Impacts/opportunities related to RPS, state initiatives (AB 1493) in climate change

$ External Funding Into State

(in $ Millions)



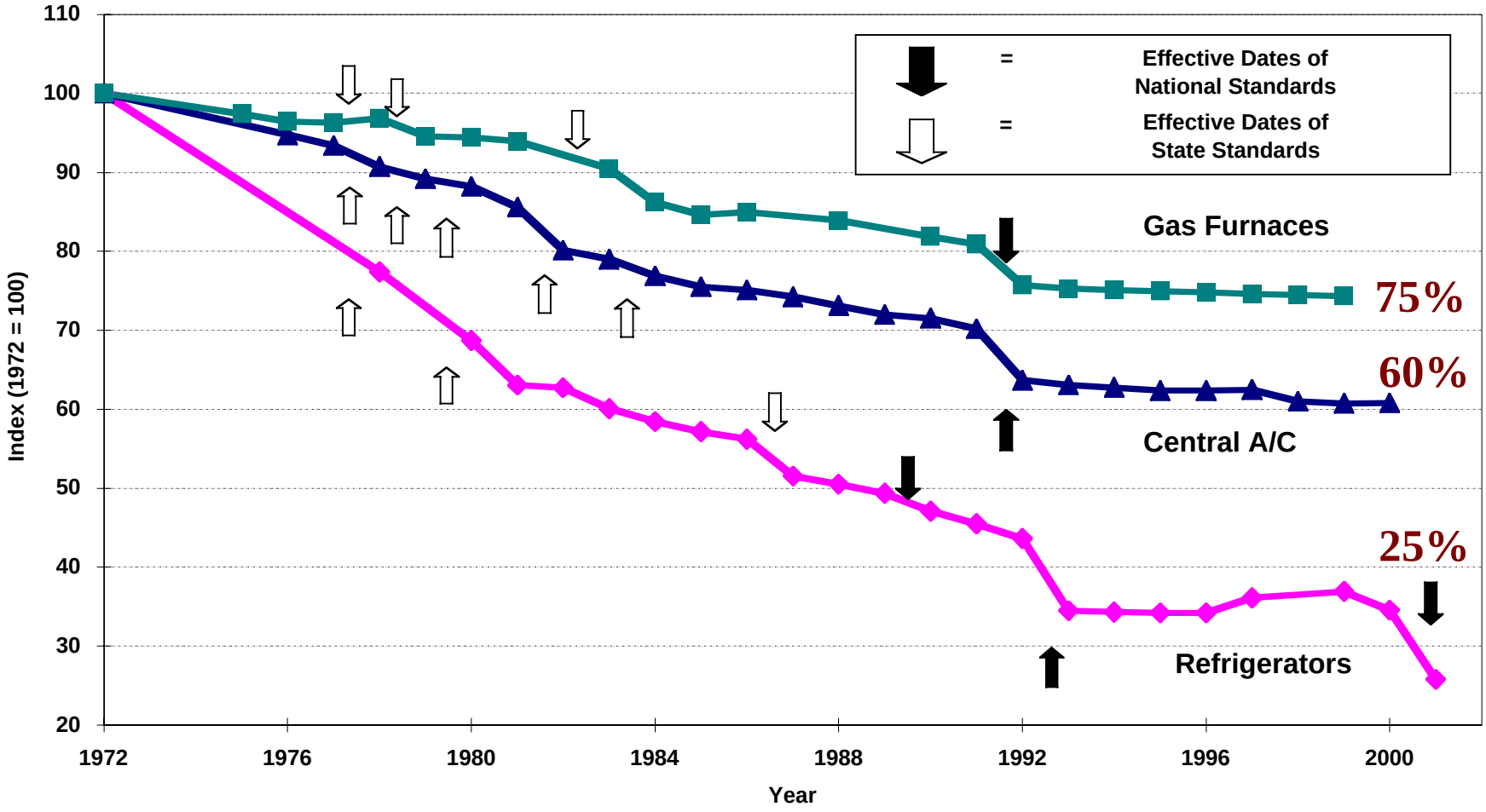
Electricity Efficiency and Renewables:

Goals of California Energy Action Plan 2003

- California kWh per capita is already flat compared to US climbing 2%/yr
- New California goal is to reduce kWh per capita by 1% per year
- Renewable Portfolio Standard: add 1% renewables per year
- Additional peak reduction of 1% per year by Demand Response when power is inexpensive or reliability is a problem

In total, goals aim to reduce electricity growth, increase renewables, and grow demand response.

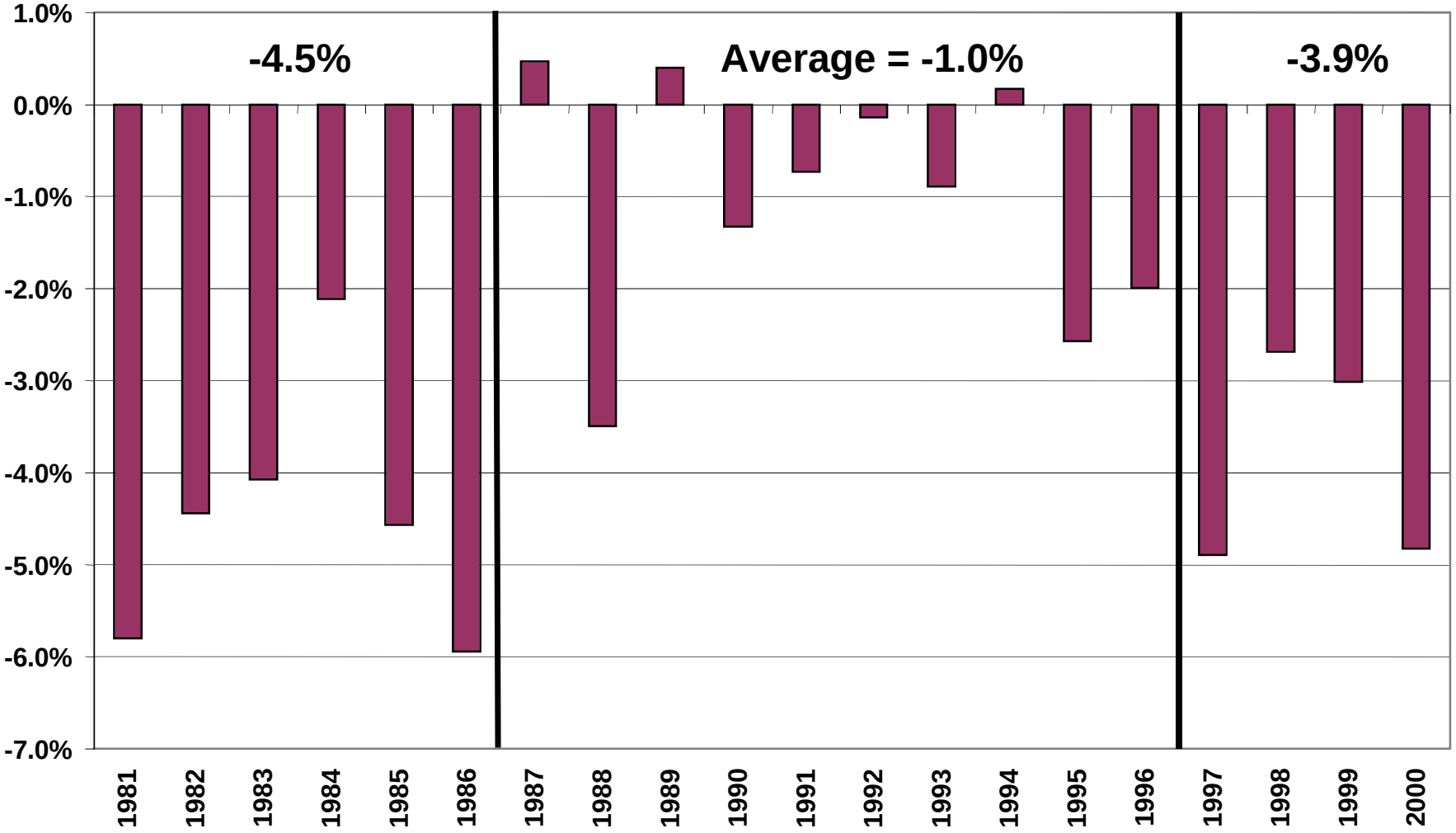
Impact of Standards on Efficiency of Three Appliances



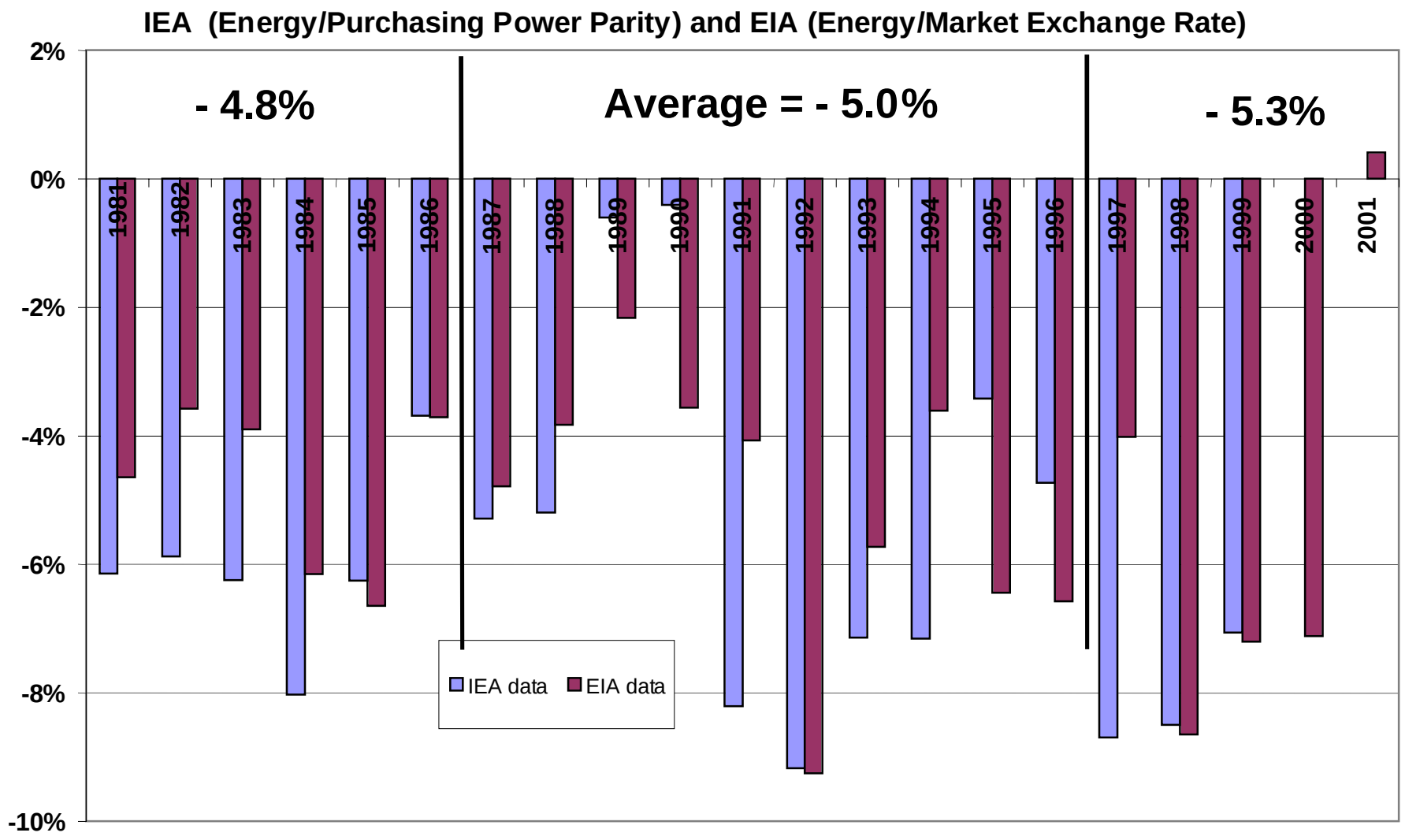
Source: S. Nadel, ACEEE, in ECEEE 2003 Summer Study, www.eceee.org

Annual Rate of Change in Energy/Gross State Product for California

(Sources: EIA and California Department of Finance)

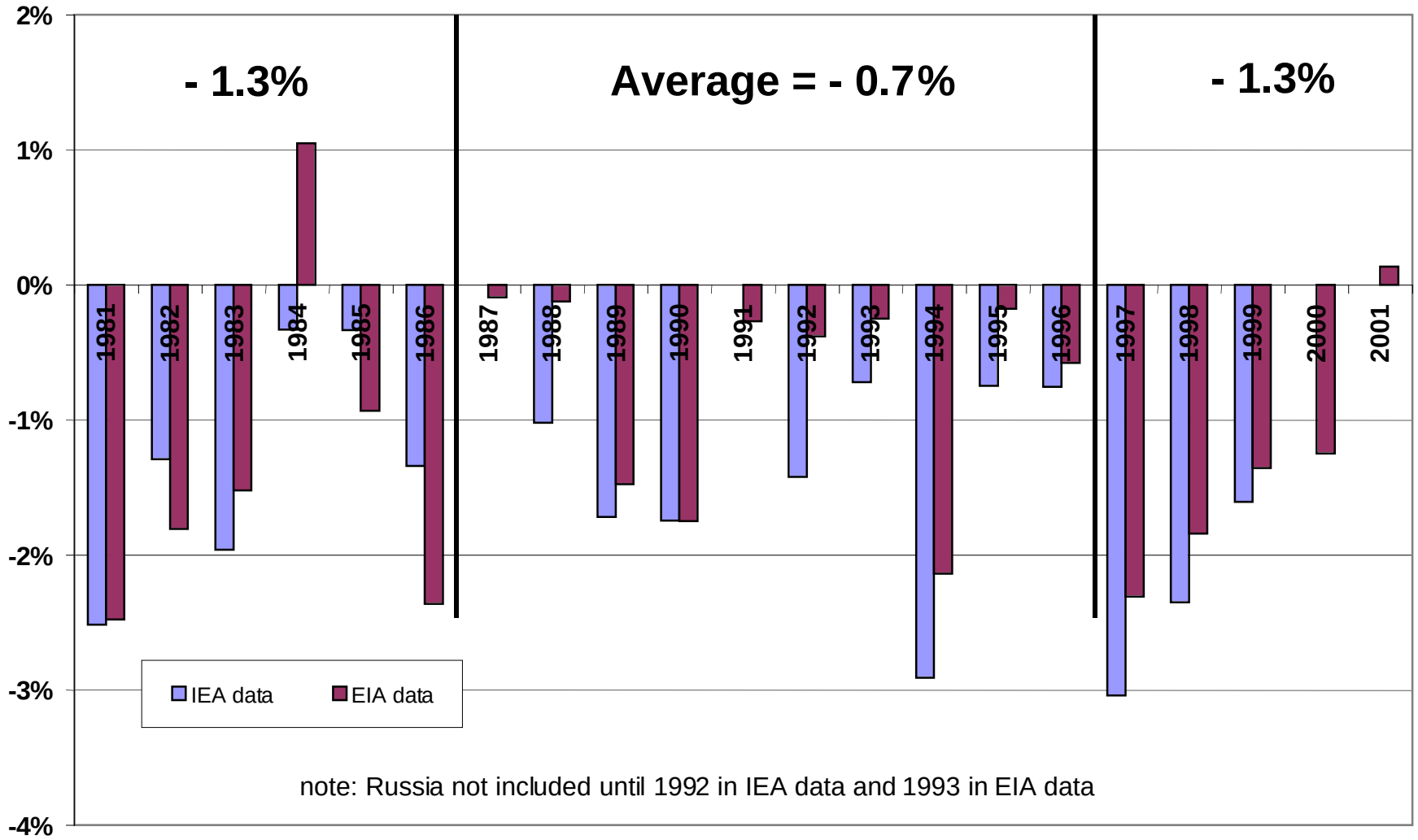


Annual Rate of Change in Energy/GDP for China



Annual Rate of Change in Energy/GDP for the World

IEA (Energy/Purchasing Power Parity) and EIA (Energy/Market Exchange Rate)



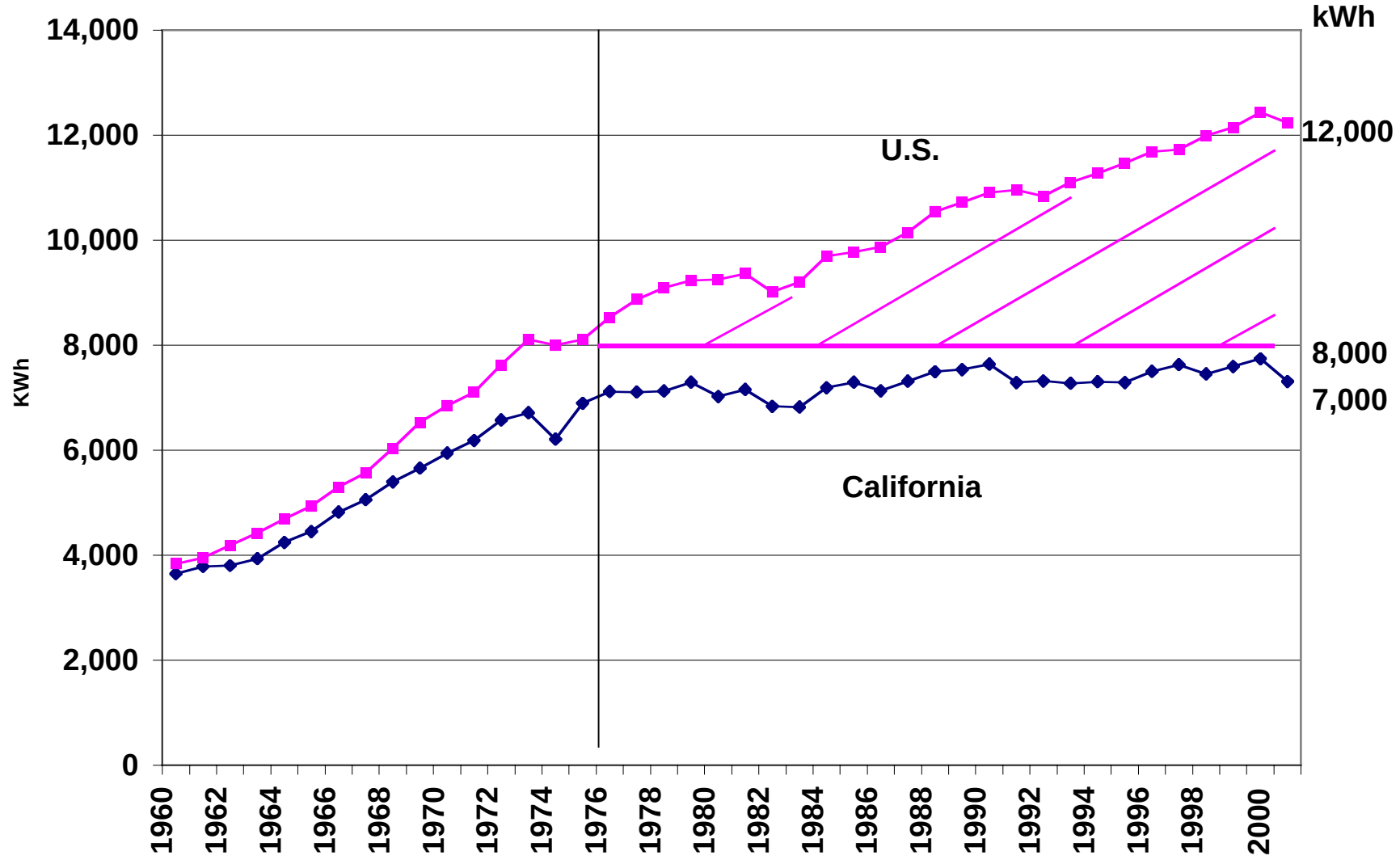
PIER Buildings Program Highlights

Berkeley Lamp

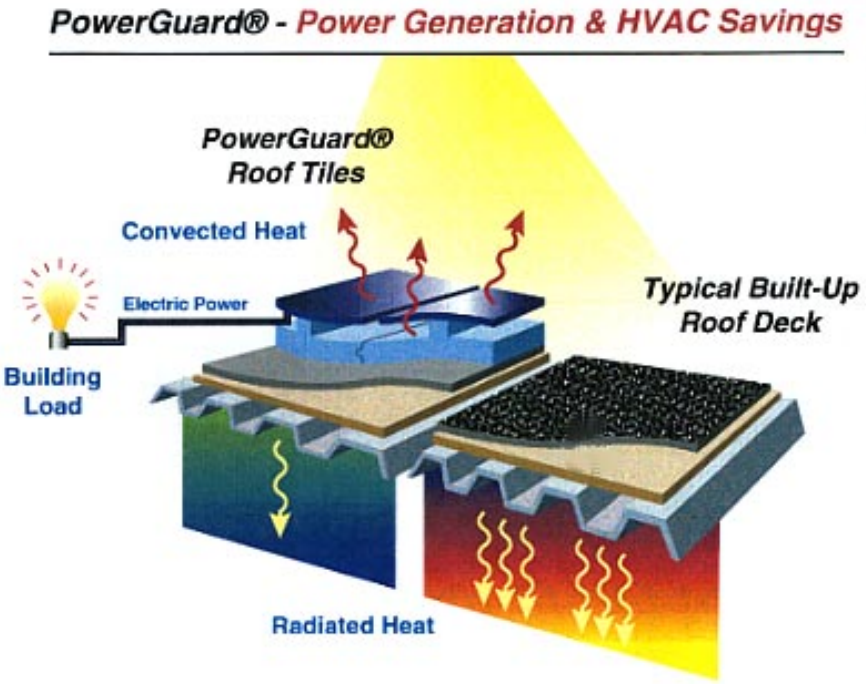
- **Model partnership between CEC/DOE/California utilities**
  - **PIER funded Phase 1 to develop task/ambient lamp concept**
  - **DOE funded Phase 2 to develop specific lamp configuration**
  - **PIER was instrumental in moving technology into the marketplace via coordination with utility Emerging Technology Coordinating Council**

Project is both a technical success and a customer success

Total Electricity Use, per capita, 1960 - 2001



PowerLight's PowerGuard



While California is known for its hot dry summers, that same solar resource provides a clean, safe and reliable way to generate electricity

PowerLight's insulated 30 year roof system reduces building air conditioning loads while it's PV surface generates electricity during hot and expensive peak summer hours

The Yolo County Success

Accomplishments

- Is opening the way for landfill gas electricity systems to be more widely used in California
  - Accelerates gas production from over 30 years to less than 10 years, making landfill electricity more competitive
  - Reduces volume of landfill which can extend landfill life by 20 percent
  - Significantly reduces the chance for groundwater pollution from leachate release
- Has become the leading bioreactor project within EPA's XL Program and will strongly influence landfill regulations across the country

CEC's Role

- Through the CEC's R&D programs, we're bringing bioreactor technology from concept to reality

Control cell without bioreactor

Enhanced bioreactor cell

Xonon Cool Combustion System - Catalytica Energy Systems, Inc.

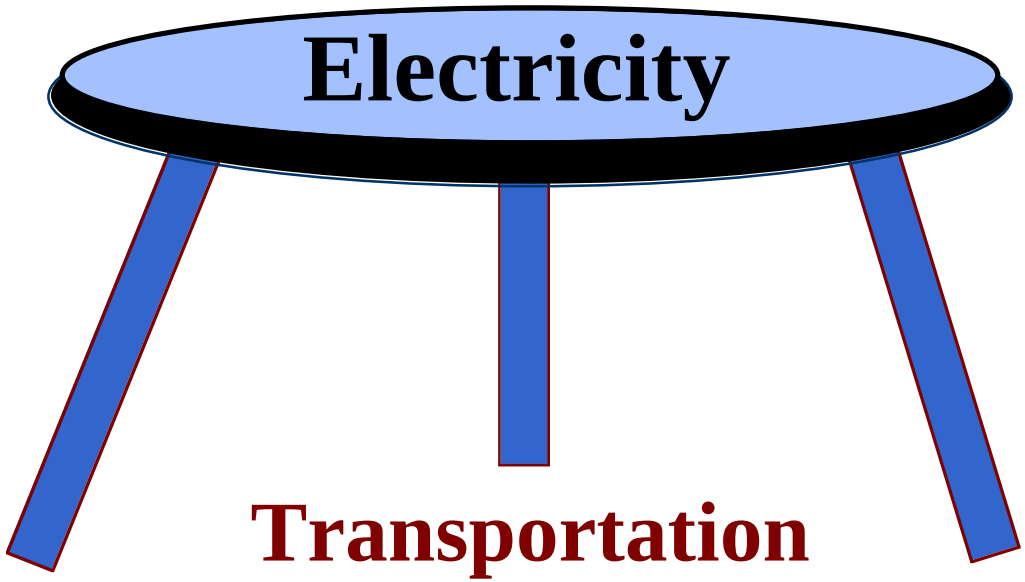
Description:

- Gas turbine combustion system that controls combustion temperature to prevent the formation of NO_X

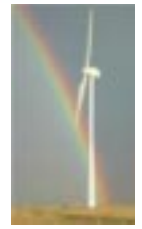
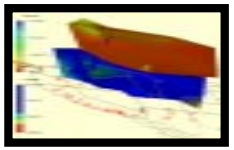
Benefits:

- Lower NO_X emissions without SCR
- Allows deployment of smaller turbines for DG
- Expandable to large, central station turbines
- Use with Kawasaki turbine

President's Commission on Critical Infrastructure Protection Highlights Vulnerabilities and Interdependencies



CEC/PIER is Already Providing a Stream of Products Consistent with the California Energy Action Plan (CEAP)

CEAP Goal	PIER Issue	Products
Optimize efficiency, Reduce demand	Reduce per capita energy use	 
Ensure power supply meet RPS	MEET RPS	 
Upgrade T&D structure	T&D System must be reliable and congestion-free	 
Promote DG	Peak demand reduction Low emissions DG Reliable, affordable DG	 
Ensure reliable supply of NG	Meet marketplace needs	 

Successful Relationships Are Critical to Enhancement of Our Activities

- **Success in connecting with peers in DOE and other agencies**
  - **Collaborative funding**
  - **Enhanced CEC visibility: Making a difference on a national level**
- **Maintaining ties with successful private sector firms**
  - **Stream of products to market**
  - **Markets must include other states and countries**
- **Tying our programs to other state activities and regulations**
  - **Political strength of programs, i.e. ARB, ADF, DWR, SVMB**
  - **Linkage of R&D to implementation: i.e. CEC Efficiency, CEC Renewables, CEC energy Export Program**

Driving to a Sustainable Future: The "E"s are Linked

- Environment
- Energy
- Economics
- Equity
- Education